

Original Research

QUALITATIVE ANALYSIS OF MERCURY AND HYDROQUINONE CONTENT IN WHITENING CREAMS CIRCULATING IN BALIKPAPAN CITY

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Abstract

Whitening cream is a preparation or mixture of ingredients used on the outside of the body to brighten or change the color of the skin, resulting in clean and white skin. Many people, particularly women, use cosmetics to improve the appearance of their skin, one of which is whitening cream. Many producers saw this opportunity and added mercury and hydroquinone to increase the number of consumers because the product will be cheaper and provide faster results to their skin with these ingredients. This study aims to conduct a qualitative analysis of whitening creams circulating in Balikpapan. To achieve this goal, four samples A, B, C, and D were analyzed using the KI color test method, the flame test, and the color reagent method to determine the presence of mercury and hydroquinone. The findings of the qualitative test of the mercury and hydroquinone content in the whitening cream circulating in the city of Balikpapan revealed that three samples, namely samples B, C, and D, were known to contain mercury and two samples (samples A and D) were known to contain hydroquinone.

Keywords: *whitening cream, mercury, hydroquinone*

INTRODUCTION

The use of facial cosmetic products has become a way of life for many people, determining their level of confidence in both facial care and makeup [1]. Some cosmetics users prefer imported products, while others prefer local products. Regardless of the origin of the cosmetic product, users prioritize products that they believe are appropriate for their skin [2]. It is reasonable to believe that there are still many cosmetic users who are unconcerned about the composition of cosmetic products and are only concerned with the results obtained by their skin.

Whitening cream is one of the cosmetic products intended for skin care. Whitening cream is a preparation or mixture of ingredients used on the outside of the body to brighten or change the color of the skin, resulting in clean and white skin. Many people, particularly women, use cosmetics to improve the appearance of their skin, one of which is whitening cream. Many producers, seeing this opportunity, add mercury and hydroquinone to increase the number of consumers [3].

Mercury is a heavy metal that is toxic to the human body even in trace amounts. According to research, mercury exposure in the human body can lead to cancer, fetal disorders, neurological

disorders, and chronic kidney disease [4]. Hydroquinone is a compound that is easily soluble in water, alcohol, and ether and darkens easily when exposed to light and air. The side effects of hydroquinone include skin irritation, redness (erythema), and burning. This effect will occur if the concentration of hydroquinone used is greater than 4%. Meanwhile, long-term or continuous exposure to hydroquinone concentrations less than 2% causes cancer [5] [6]. According to some of the data presented above, no matter how low the concentration of mercury and hydroquinone used in whitening creams is, it will still harm the user.

From June 2020 to September 2021, the Indonesian Food and Drug Supervisory Agency (BPOM) have found as many as 72 dangerous products circulating in the market where these hazardous products contain mercury and hydroquinone. Based on the following, it is critical to conduct research on the qualitative analysis of mercury and hydroquinone content in several whitening creams circulating in Balikpapan, East Kalimantan.

METHODS

Materials

The materials used in this study were samples of whitening cream which were suspected to contain mercury and hydroquinone taken from a cosmetic shop located in the city of Balikpapan, potassium iodide (KI) 0.5 N, concentrated hydrochloric acid (HCl), concentrated nitric acid (HNO₃), iron (III) chloride (FeCl₃), and distilled water.

Instruments

The tools we used in this study are a set of laboratory glassware, a test tube rack, and a bunsen burner.

Procedure

Mercury Qualitative Analysis

KI Color Test: 2 g of sample was put into a porcelain dish, then added HNO₃, heated using Bunsen, and then filtered. 1 mL of filtered test solution was put into a test tube, then 5 drops of 0.5 N KI solution were added slowly through the wall of the test tube. The result is positive if a green precipitate (HgI) is formed and after boiling a red precipitate of mercury(II)iodide and black mercury is formed which is fine-grained [7] [8].

Flame Test: 1.25 g of sample was added with 1.25 mL of distilled water and then added with 0.5 mL of concentrated HCl. The sanded copper wire is then dipped into the test solution mixture. The wire is burned in a Bunsen flame. A positive result is indicated by the change of the flame to green [7].

Hydroquinone Qualitative Test

Color Reagent Test: 1 gram of sample is placed on a drip plate then 3 drops of FeCl₃ reagent are added. Positive samples containing hydroquinone were indicated by a color change from greenish to black. [7]

RESULT AND DISCUSSION

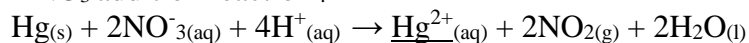
The addition of mercury and hydroquinone in whitening cream aims to speed up the skin whitening process and remove black spots on the face [4][5]. Mercury is a heavy metal that is toxic to the human body even in trace amounts. According to research, mercury exposure in the human body can lead to cancer, fetal disorders, neurological disorders, and chronic kidney disease [4]. Hydroquinone is a compound that is easily soluble in water, alcohol, and ether and darkens easily when exposed to light and air. The side effects of hydroquinone include skin irritation, redness (erythema), and burning. This effect will occur if the concentration of hydroquinone used is greater than 4%. Meanwhile, long-term or continuous exposure to hydroquinone concentrations less than 2% causes cancer [5] [6]. According to some of the data presented above, even if the concentration of mercury and hydroquinone used in whitening creams is low, the user will still be harmed.

Qualitative analysis of mercury and hydroquinone content was carried out on 4 brands of whitening cream circulating in the city of Balikpapan, two of which are brands that are well known nationally. The four whitening creams were then labeled with samples A, B, C, and D.

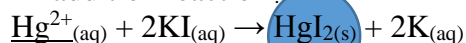
Mercury Qualitative Analysis

Because of the nature of mercury metal, which easily reacts with concentrated HNO_3 , the addition of concentrated HNO_3 in the KI color reagent test aims to dissolve mercury metal in the sample [9]. The mercury metal that has settled will then react with KI to produce a compound HgI_2 (mercury (II) iodide). The reaction that occurs is shown by the following reaction equation:

HNO_3 addition reaction :



KI addition reaction :



A change in the color of the precipitate to blackish red or orange red indicates the formation of HgI_2 compounds [7] [9]. As shown in Figure 1, two of the four samples tested positive for mercury, namely samples C and D.



Figure 1. The results of the qualitative test of mercury, using the KI staining method. Samples C and D showed the formation of HgI_2 compounds.

Samples B and C showed a bluish-green color in the flame test, indicating mercury contamination (Figure 2). When a chemical compound is heated, the constituent atoms decompose and absorb some energy (excitation state). Because the metal atom is unstable in this state, it is simple to return to its initial state by emitting the absorbed energy in the form of light. Because the metal atom is unstable in this state, it is simple to return to its initial state by emitting the absorbed energy in the form of light. A bluish-green flame in the sample is indicated by the presence of metal Hg, according to the reaction equation: $\text{Hg}^{2+} + \text{Cu} \rightarrow \text{Hg} + \text{Cu}^{2+}$.

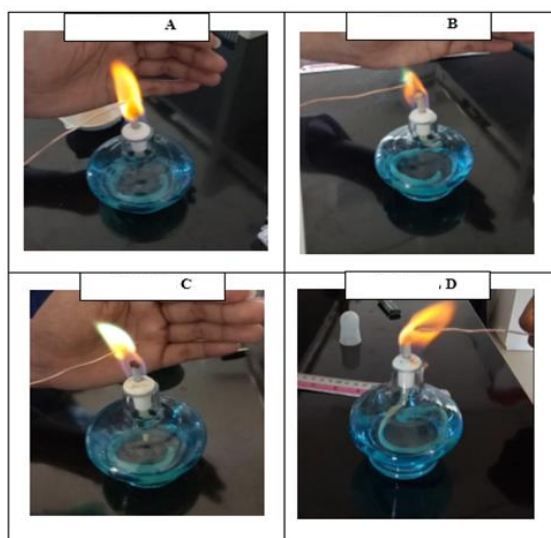


Figure 2. Mercury qualitative analysis results, using the flame method. Sample A, showed negative mercury, Sample B showed positive mercury, Sample C showed positive mercury and Sample D showed negative mercury.

Table 1 shows the results of the qualitative analysis of the mercury content in samples A, B, C, and D:

Table 1. The Findings of The Qualitative Mercury Analysis in Whitening Cream

Sample	Mercury	
	KI Color Test	Flame Test
A	-	-
B	-	+
C	+	+
D	+	-

Based on the table above, it can be concluded that sample A does not contain mercury, sample B contains mercury, sample C contains mercury, and sample D contains mercury.

Hydroquinone Qualitative Analysis

The reaction of Hydroquinone and FeCl_3 will produce a complex compound. Complex compounds are formed because the element O in hydroquinone binds with FeCl_3 to form a reaction that produces a green to black color in acidic conditions [7]. The qualitative analysis showed that samples A and D changed color to blackish green (Figure 3), while samples B and C did not show any color change. Based on the color produced by each sample, it is concluded that samples A and D are hydroquinone positive.



Figure 3. The results of the qualitative analysis of hydroquinone using the FeCl_3 method Sample A was positive for hydroquinone, Sample B was negative for hydroquinone, Sample C was negative for hydroquinone, and Sample D was positive for hydroquinone.

CONCLUSION

According to the findings of the study, three of the four samples were thought to contain mercury (sample B, C, and D) and two were thought to contain hydroquinone (sample A and D) based on the results of a qualitative analysis of the mercury and hydroquinone content in the whitening cream circulating in the city of Balikpapan.

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